THE IMPACT OF CARE COORDINATION ON THE PROVISION OF HEALTH CARE SERVICES TO DISABLED AND CHRONICALLY ILL MEDICAID ENROLEES

(TEXAS STAR PLUS FOCUS STUDY**)**

Sema K. Aydede, Ph.D.

Institute for Child Health Policy

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Table of Contents

List of Tables and Figures

List of Tables

List of Figures

Appendices

EXECUTIVE SUMMARY

Focus Study Objective

The primary aim of this report is to provide information about the impact of care coordination on the provision of health care services to a census of disabled and chronically ill Medicaid beneficiaries enrolled in the STAR+PLUS program. The care coordination provided in the managed care environment of the STAR+PLUS program becomes especially crucial when the integration of acute and long term care services involves beneficiaries who are receiving community-based long term care services. As a result, this study specifically focuses on the STAR+PLUS beneficiaries who are receiving community-based long term care services in its assessment. The health care outcomes that are emphasized are inpatient stays, emergency department visits and total health care costs.

The Evaluation

This study employs a quasi-experimental design in examining the impact of care coordination on the use and costs of health care services for a census of STAR+PLUS beneficiaries. The experiment group consisted of Medicaid-only adult SSI STAR+PLUS enrollees with Day Activity and Health Services (DAHS) or Personal Assistance Services (PAS). The control group consisted of adult SSI clients with DAHS or PAS services enrolled in the Texas STAR managed care program.

There are several advantages of employing information from the STAR managed care program in formulating a comparison group for the STAR+PLUS enrollees with DAHS or PAS services. Both programs offer health care services in managed care environments. Primary care providers serve as a medical home in both programs. But there is also a shortcoming of focusing on the STAR SSI clients in the formulation of the control group since enrollment in the STAR managed care program is not mandatory for SSI clients.

Findings from this study show that the voluntary nature of enrollment for SSI beneficiaries in the STAR managed care program does result in a self-selection process and a healthier group of SSI beneficiaries with DAHS or PAS services are enrolled in the STAR managed care program when compared to a similar group of STAR+PLUS enrollees.

Given the healthier group of managed care STAR SSI clients with DAHS or PAS services statewide, we relied on stratified random sampling in formulating the experiment and control groups for the analysis of the impact of care coordination. Clinical Risk Group (CRG) classifications on health status and severity of illness were used in this stratification process in order to match the case-mix of the control group to that of the experiment group. STAR+PLUS and STAR enrollment and encounter data set were used for the analysis.

This study also provides a comparison of the two STAR+PLUS managed care organizations (MCOs). Health care outcomes that were used for the MCO analysis are inpatient stays, emergency department visits and total health care costs.

Key Findings

Key findings on the impact of care coordination are summarized below.

- Based on findings from this study, care coordination efforts in the STAR+PLUS program are having a positive impact on reducing inpatient stays and emergency department use relative to the control group. Specifically, results at the descriptive level showed that SSI beneficiaries with DAHS or PAS services enrolled in the Texas STAR managed care program (the control group) have higher rates of inpatient stays and higher rates of emergency department visits when compared to the use rates for SSI beneficiaries with DAHS or PAS services enrolled in the STAR+PLUS managed care program (the experiment group).

These results persisted after controlling for age, gender and case-mix and were statistically significant.

- A comparison of the total health care expenditures at the descriptive level revealed that SSI clients with DAHS or PAS services enrolled in the STAR managed care program have higher PMPM expenditures than SSI clients with DAHS or PAS services enrolled in the STAR+PLUS managed care program. Further, it was found that the discrepancy in PMPM expenditures are quite pronounced for chronic CRG categories. Results from multivariate analysis also show that PMPM expenditures are lower for the STAR+PLUS group after controlling for age, gender and case-mix. This result was statistically significant.

Summary of findings from the analysis at the STAR+PLUS MCO level are as follows:

- A comparison of the use rates for inpatient stays and emergency department visits across STAR+PLUS MCOs indicated differences at the descriptive level. Specifically, for the sample considered in this focus study, Plan 2 enrollees with DAHS or PAS services have higher rates of inpatient stays and higher rates of emergency department visits when compared to the use rates for those enrollees with DAHS or PAS services in Plan 1. These results persisted after controlling for age, gender and case-mix and were statistically significant.

- A comparison of the total health care expenditures across STAR+PLUS MCOs showed that, on average, SSI clients with DAHS or PAS services enrolled in Plan 2 have higher expenditures when compared to expenditures for those enrolled in Plan 1. This result persisted after controlling for age, gender and case-mix and was statistically significant.

FOCUS STUDY OBJECTIVE

The primary aim of this report is to provide information about the impact of care coordination on the provision of health care services to a census of disabled and chronically ill Medicaid beneficiaries enrolled in the STAR+PLUS program. The care coordination provided in the managed care environment of the STAR+PLUS program becomes especially crucial when the integration of acute and long term care services involves beneficiaries who are receiving community-based long term care services. As a result, this study specifically focuses on STAR+PLUS beneficiaries who are receiving community-based long term care services in its assessment.

The health care outcomes that are emphasized in this assessment are inpatient stays, emergency department visits and total health care costs. The assessment for these outcomes was carried out at two levels:

- First, health care outcomes for STAR+PLUS beneficiaries receiving community-based long term care services were analyzed at the STAR+PLUS health plan level.
- Second, information from a subset of SSI population enrolled in the Texas STAR managed care program was employed in assessing the overall impact of care coordination for STAR+PLUS beneficiaries receiving community-based long term care services.

BACKGROUND ON STAR+PLUS PILOT PROJECT

The provision of adequate healthcare services to patients with complex healthcare needs typically requires the coordination of services across multiple sources of providers and agencies unless the care is provided in an integrated delivery system.[1,2,3] Consider, for example, the case of a patient recently discharged from a hospital who is in need of community-based long term care services. Appropriate continuum of care for this patient

will involve input from providers in disparate organizations such as hospital, home health and social service agencies. In this case, a smooth transition to community-based care could be achieved by careful planning and coordination of the services provided by different organizations. As a result of planning and coordination, discharge arrangements from hospital would include the specifics of the community-based care required. There will be a mechanism in place to alert the community-based professionals so that the supplies and the equipment required for the continuum of care needed for the patient would be ready without disruption of services during this transition period.

The Texas STAR+PLUS pilot program is specifically designed to deal with these types of coordination issues that often arise in the provision of health care to patients with complex needs. Following the Senate Concurrent Resolution 55 passed by Texas legislature in 1995, Texas Health and Human Services Commission utilized a combined 1915(b) and 1915(c) waiver authority in developing the pilot program.[4] As a result, STAR+PLUS program implemented in Harris County in Houston, Texas aims at providing a seamless continuum of care for disabled and chronically ill Medicaid patients by integrating acute and long term care services in a managed care environment.[5]

Managed care organizations (MCOs) participating in this pilot program are responsible for coordinating acute and long term care needs of Medicaid populations through the use of a Care Coordinator. It is imperative that the MCO assigns a Care Coordinator to all Medicaid recipients who are currently receiving or in need of long term care services. For Medicaid recipients who are not receiving long term care services at the present time, a Care Coordinator is assigned if the beneficiary requests one. In this program, Medicaid recipients have a designated Care Coordinator in addition to a Primary Care Provider (PCP). The PCP operates as a medical home and is responsible for seven days a week and 24-hours a day coverage.

Primary responsibilities of the Care Coordinator in Texas pilot project encompass the management of all services necessary to meet the health care needs of Medicaid recipients. At the initial phase, the Care Coordinator is envisioned working with the

Medicaid recipient, his PCP and his family member or his representative in assessing the recipient's health status and formulating an individualized plan that covers his primary, acute and long term care needs. After this initial assessment, for the Medicaid recipient requiring long term care, the Care Coordinator first assesses all community-based options thoroughly while the institutional option is reserved as a last alternative. An important part of this care coordination process involves discussing the options with beneficiary and his family member/representative. Once the long term care plan is finalized, the Care Coordinator is responsible for the coordination of activities so as to ensure a smooth transition in the continuum of care for the Medicaid recipient. In cases where the beneficiary is best served in a community-based care, the Care Coordinator is responsible working with other community organizations so that the beneficiary's access to non-Medicaid services will be secured.

This study focuses on the impact of care coordination on health care outcomes. It builds on earlier studies that revealed encouraging tendencies in certain areas.[6] Specifically, Borders and colleagues have shown that the frequency of emergency room visits was reduced to a great extent under the STAR+PLUS program when compared to the baseline fee-for-service rates. At the same time, MCOs participating in the program to a great extent meet criteria for availability and access to services. Subsequent studies about the STAR+PLUS program have shown increases in the long term care services provided to beneficiaries. This study builds on this knowledge base by focusing on the consequences of care coordination for members receiving acute and long term care services from the integrated system provided within the STAR+PLUS program. It explores the impact of care coordination on client satisfaction with services and on health care outcome measures.

STUDY DESIGN AND STUDY QUESTIONS

Study Design

In this focus study, the evaluation of the STAR+PLUS program consists of two components. The first component employs a quasi-experimental design in examining the impact of the STAR+PLUS program on use and costs of health care services for a census of disabled and chronically ill Medicaid members. The second component consists of employing survey techniques in assessing the members' satisfaction with care coordination.

This report presents results from the first component of the study. Results from the second part of the study will be represented as an addendum. The completion of the survey part of the study is taking longer than expected due to difficulties in reaching members that meet the criteria for inclusion in this study. But every effort is being made in order to reach the beneficiaries in the STAR+PLUS and the STAR control samples. One of the tasks undertaken towards this end involves a structured search for missing phone numbers employing all of the other information that is found in the files housed at the Institute for Child Health Policy (ICHP) for these clients.

In the first component of the focus study, the treatment group consisted of beneficiaries enrolled in one of the two health care delivery systems that make up the STAR+PLUS program[1]. The health delivery system we focused on is represented by STAR+PLUS MCOs. This system symbolizes a highly integrated health care delivery to disabled and chronically ill Medicaid members. STAR+PLUS MCOs, namely Americaid and HMO Blue (in the time period that this study is focusing on), are responsible for the provision

[1] One of the two health care delivery systems that make up the STAR+PLUS program is Primary Care Case Management (PCCM). In this system, each STAR+PLUS member's health care is coordinated by a PCP. PCPs receive Medicaid fee-for-service payments for health care services rendered and a $3.00 per member per month case management fee. Since this study examines the impact of care coordination on long term care services, it focuses on the second health care delivery system in the STAR+PLUS program, i.e., the managed care system where the coordination of acute and long term care services is an integral part of the health care delivery system.

of preventive, acute and long term care for their Medicaid-only enrollees. For their dual eligible enrollees, MCOs are responsible for providing long term care.

The dual eligible enrollees were not included in this study for two reasons. One reason is related to our efforts in getting as pure a STAR+PLUS program impact on health care outcomes as possible. Since STAR+PLUS plans do not have control over the acute care that dual eligible enrollees are receiving from their Medicare plans, we did not want to confound our results with this. Second, the highly integrated health care delivery system that is the focus of this study is not present for dual eligible enrollees. As a result, the analysis was limited to Medicaid-only STAR+PLUS members.

The responsibilities of the Care Coordinator become most crucial when the integration of acute and long term care services involves those receiving community-based long term care services. This is the reason why the analysis in this study was further limited to adult STAR+PLUS enrollees with Day Activity and Health Services (DAHS) and Personal Assistance Services (PAS). Day Activity and Health Services are defined as "daytime services Monday through Friday to clients residing in the community in order to provide an alternative to placement in nursing homes or other institutions. Services are designed to address the physical, mental, medical, and social needs of clients. Services include nursing and personal care; physical rehabilitation; noon meal and snacks; transportation; and social, educational, and recreational activities". Personal Assistance Services "provide assistance to participants in performing the activities of daily living based on their individual needs and plan of care. Personal Assistance Services include personal care services, performing household chores. The provider must assure that there is no break in scheduled services".[7]

Given the fact that eligible persons were not assigned randomly to STAR+PLUS pilot project, we were unable to work with an ideal study design such as a randomized control trial in analyzing program effects. To compensate for this inadequacy, however, we chose a similar group of SSI enrollees in the Texas STAR managed care program. As will be discussed in detail below, we initially focused on Harris Contiguous Counties in

formulating the control group. Overall number of adult STAR SSI enrollees with DAHS or PAS services in Harris Contiguous Counties (n=56) were not sufficient to form a control group. Further analysis revealed that the adult STAR SSI group with DAHS or PAS services in Harris Contiguous Counties is healthier than the adult STAR+PLUS SSI enrollees with DAHS or PAS services. In order to form a control group with a similar case-mix to adult STAR+PLUS SSI enrollees with DAHS or PAS services, we have expanded our search to all SSI enrollees with DAHS or PAS services in the Texas STAR managed care program. Details of control group selection are provided in the following sections.

Study Questions

In the first part of the focus study, following questions are addressed:

> Question 1: Are there differences in health care outcomes across STAR+PLUS HMOs?
> Question 2: How does Care Coordination provided in the STAR+PLUS program affect health care outcomes?
> Question 3: Does the Care Coordination provided in the STAR+PLUS program affect health care outcomes differently for enrollees in different health status groups?

Health care outcome measures that were taken into consideration in this section are emergency department visits, hospital inpatient stays and total health care costs.

The second part of this focus study which will be presented as an addendum relies on survey techniques. In this part of the study, following questions will be addressed:

> Question 1: How satisfied are beneficiaries with the care they receive in the integrated system of the STAR+PLUS program with Care Coordination? Does the level of satisfaction for the STAR+PLUS beneficiaries vary with health plan?

Question 2: Does satisfaction with Care Coordination provided in the STAR+PLUS program differ for beneficiaries in different health status groups?

These questions were studied both at the descriptive and multivariate level.

DATA SOURCES AND MEASURES USED

For the first part of this focus study, data from two Texas programs were employed. For the experiment or intervention group, we used information contained in the STAR+PLUS enrollment and encounter datasets. For the control group, we employed data from the STAR managed care program in Texas.

Clinical Risk Group (CRG) Health Status Categories

In this study, Clinical Risk Groups (CRGs) were one of the methods used in case-mix classifications. The enrollees in experiment and control groups were classified into mutually exclusive Clinical Risk Group (CRG) categories using the CRG software. This software uses standard claims and encounter information including ICD-9-CM diagnostic codes, American Medical Association's Current Procedural Terminology (CPT) codes, Centers for Medicare and Medicaid Services' Level II HCPC codes, number of encounters, site of service and provider type to assign each patient into a single mutually exclusive and clinically meaningful risk category.

The CRG clinical logic requires several analytical phases in creating a final classification of patients.[8] In the first phase, information on all services rendered during a given time period are examined to create a disease profile and a history of intervention for each patient in the sample. At this stage, all diagnostic and procedure codes for each patient in the sample are evaluated against preclassified disease categories. In CRG clinical system, disease preclassification involves two levels. At the first level, each disease is classified into one of the 533 Episode Diagnostic Categories. These categories are then clustered into 31 hierarchically ordered Major Diagnostic Categories representing either a single body system (such as respiratory) or a major disease category (such as malignancies).

In the second phase of creating a final classification for patients, each patient's primary chronic disease is selected. This phase is especially critical when the claim and encounter information reveal more than one chronic Episode Diagnostic Category in a single organ system for a patient. In this case, the choice of primary chronic disease depends on input from several fields such as the hierarchy of Episode Diagnostic Categories for that organ system, site and frequency of treatment during the specified study period. Once the primary chronic condition is selected, a severity level is assigned to each patient. Severity level selection is based on information such as the specifics of the primary chronic disease, presence of comorbid chronic conditions, age of the patient, and site and frequency of treatment. After assigning a severity level to each primary care diagnosis, each patient is assigned to one of the nine mutually exclusive core CRG health status groups.

As will be discussed below, we employed these nine CRG health status groups in classifying enrollees with respect to the complexities of their medical condition in our study. These core groups are hierarchically ordered from least to most complex medical conditions. Specifically, the first core CRG group represents healthy enrollees. Members with no medical encounters are included in this category. This category also includes minor acute illnesses, i.e., conditions that do not place the individual at increased risk for developing chronic conditions in the future. Fracture lower limb minor, appendicitis and upper respiratory infection are examples of minor acute illnesses. The second CRG category is comprised of significant acute conditions. These conditions are defined as serious acute illnesses that put the patient at risk for developing chronic conditions. Examples for this category include spinal cord injury and pneumonia.

The rest of the core CRG categories (i.e., single minor chronic condition; minor chronic conditions in multiple organ systems; single dominant or moderate chronic conditions; dominant or moderate chronic conditions in two organ systems (pairs); dominant or moderate chronic conditions in three or more organ systems (triplets); dominant, metastatic and complicated malignancies; and catastrophic conditions) represent chronic conditions with increasing degree of complexity. In general, minor chronic conditions

are those that could be managed with few complications and are non-progressive. These conditions, such as migraine, cataracts, chronic bronchitis, depression and chronic hearing loss, have low risk of increased need for further medical attention. The most important characteristic of moderate chronic conditions is the variability in their severity and progression. Examples of these conditions include epilepsy, asthma and major depressive disorder. Dominant chronic conditions, on the other hand, are very serious illnesses that mostly result in increased deterioration of health. Examples of these potentially disabling chronic conditions include sickle cell anemia, spina bifida, schizophrenia and diabetes. Some of the catastrophic conditions that are included in CRG classification are organ transplant history, cystic fibrosis and HIV.

Description of Outcome Variables: Use and Expenditure

Health care outcome measures that were taken into consideration in this focus study are emergency department visits, hospital inpatient stays and total health care costs.

We relied on the coding of the procedures and services performed as captured by the American Medical Association's Current Procedural Terminology (CPT) codes and revenue codes in grouping inpatient, emergency department and outpatient services. We employed NHIC Texas Medicaid Fee schedule augmented by fees for STAR+PLUS specific local codes in assigning charges to services captured by CPT, Centers for Medicare and Medicaid Services' Level II HCPC codes, and local codes.

SAMPLE CHARACTERISTICS AND THE CHOICE OF CONTROL GROUP

STAR+PLUS Clients in the Study Sample ─ The Experiment Group

As discussed above, this study focuses on Medicaid-only adult SSI STAR+PLUS enrollees with DAHS or PAS services. Two methods were employed in identifying STAR+PLUS enrollees with DAHS or PAS services. First, Service Authorization Files were used in identifying STAR+PLUS enrollees with DAHS or PAS services[2]. Second, we relied on STAR+PLUS encounter files in this identification process. The local codes used for identifying enrollees with DAHS or PAS services are presented in Appendix A. Results from these two methods were brought together for the final sample of enrollees with DAHS or PAS services.

As Table 1 shows, off the 17,717 Medicaid-only adult SSI STAR+PLUS clients enrolled in the program for at least 3 consecutive months during State Fiscal Year 2002, 13.07% were receiving DAHS or PAS services. Medicaid-only adult SSI STAR+PLUS clients receiving DAHS or PAS services are, on average, older than clients without DAHS or PAS services. The proportion of female clients is greater in the group receiving DAHS or PAS services (63.11%) than the proportion in the group without DAHS or PAS services. Medicaid-only adult SSI STAR+PLUS clients receiving DAHS or PAS services are mostly black and/or of Hispanic origin (67.82%) and almost all live alone (95.98%).

[2] We would like to thank to STAR+PLUS staff for taking the time to go over Service Authorization Files to identify clients with DAHS or PAS services.

Table 1: Selected Characteristics of Medicaid-Only Adult STAR+PLUS SSI Clients with and without DAHS or PAS Services

Category	Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services	Medicaid-Only Adult STAR+PLUS SSI Clients without DAHS or PAS Services
N	2315	15402
Mean (SD) Age	48.37 (12.83)	45.98 (13.11)
Gender		
% Female	63.11	56.62
% Male	36.89	43.38
Race/Ethnicity		
% White	20.82	24.09
% Black	56.50	46.44
% Hispanic	11.32	15.43
% Other	11.36	14.05
Family Size		
% Single	95.98	94.64
% 2 persons	4.02	5.30
% 3 and above	0.00	0.04

Table 2 provides information on the relative case-mix of the two Medicaid-only groups in the STAR+PLUS program. The reader will note that some beneficiaries are classified as "healthy" in both of these Medicaid-only groups even though they all met program eligibility requirements which include the presence of chronic conditions. The CRGs classify enrollees according to diagnoses observed in the encounter files during the time period for which the enrollee is being classified. (For this study, State Fiscal Year 2002 was used as the CRG classification time period.) The category of "healthy" means that during the classification time period the enrollee was seen for routine needs that did not require the recording of their chronic condition. For example, enrollees with chronic conditions can be seen for routine health care as well as minor illnesses, such as respiratory infections. This routine care or the minor conditions would be documented in the encounter data and the enrollee would be classified as healthy.

As Table 2 shows, the relative case-mix of the two Medicaid-only groups in the STAR+PLUS program is very different. Of the 2315 Medicaid-only adult SSI STAR+PLUS clients with DAHS or PAS services, only 3.33% were identified as healthy employing CRG clinical grouping system. In the group that represents Medicaid-only adult SSI STAR+PLUS clients without DAHS or PAS services, however, 37.55% were identified as healthy employing the CRG software. While those with chronic conditions make up 94.81% of Medicaid-only adult SSI STAR+PLUS clients with DAHS or PAS services, this proportion falls to 57.65% in Medicaid-only adult SSI STAR+PLUS group without DAHS or PAS services.

Table 2: CRG Health Status Categories for Medicaid-Only Adult STAR+PLUS SSI Clients with and without DAHS or PAS Services

CRG Health Status Categories	Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services		Medicaid-Only Adult STAR+PLUS SSI Clients without DAHS or PAS Services	
	No of Clients	Percent	No of Clients	Percent
1 Healthy	77	3.33	5783	37.55
2 Significant Acute	43	1.86	740	4.80
3 Single Minor Chronic	60	2.59	762	4.95
4 Multiple Minor Chronic	16	0.69	226	1.47
5 Single Dominant or Moderate Chronic	713	30.80	3743	24.30
6 Pairs-Dominant & Moderate Chronic in 2 Organ Sys	850	36.72	2875	18.67
7 Triplets-Dom. & Mod. Chronic in 3 or more Organ Sys	220	9.50	323	2.10
8 Malignancies-Metastatic, Complicated or Dominant	60	2.59	162	1.05
9 Catastrophic	276	11.92	788	5.12
TOTAL	2315	100.00	15402	100.00

STAR Managed Care Clients in the Study Sample – The Control Group

This study relies on information from the STAR managed care program, the Medicaid managed care program in Texas, in formulating a comparison group for STAR+PLUS enrollees with DAHS or PAS services[3]. There are several advantages of employing information from the STAR managed care program in forming a control group for STAR+PLUS clients. One of these advantages is that both programs offer health care services in a managed care environment. Further, dual eligible clients cannot enroll in the STAR managed care program. This feature of the STAR managed care program parallels the characteristics of the group of clients that this study is focusing on in the STAR+PLUS program, i.e., the Medicaid-only STAR+PLUS beneficiaries. In both STAR and STAR+PLUS programs, beneficiaries choose a primary care provider (PCP) who will serve as a medical home. This provides an opportunity to assess the impact of an integrated system with care coordination that is an integral part of the STAR+PLUS program for Medicaid-only beneficiaries while keeping the financing scheme and the availability of medical home constant.

In order to get a better match on characteristics other than the ones that are of interest for this study between the control group and the STAR+PLUS group, certain restrictions were imposed on STAR managed care beneficiaries. Similar to the STAR+PLUS group, STAR managed care clients in the control group were limited to those SSI adults receiving DAHS or PAS services who had been in the program for at least 3 consecutive months during State Fiscal Year 2002.

One of the shortcomings of focusing on STAR SSI clients in the formulation of the control group is that enrollment in the STAR managed care program is not mandatory for SSI clients. Unlike some of the other Medicaid groups, SSI clients who live in the STAR managed care program service delivery areas are given the option of either staying in the regular Medicaid program or enrolling in the STAR managed care program. We were

[3] We would like to thank to STAR+PLUS staff for providing us with a file that was used in identifying STAR SSI clients with DAHS or PAS services.

concerned that the voluntary nature of enrollment for SSI beneficiaries in the STAR managed care program may result in a self-selection process where a healthier group of SSI beneficiaries would end up enrolling in the STAR managed care program.

We used information from CRG health status assignments to examine the possibility of self-selection for STAR SSI group receiving DAHS or PAS services. As Table 3 shows, this examination was first carried out for beneficiaries living in Harris Contiguous Counties. Since the STAR+PLUS program is implemented in Harris County, we first attempted to formulate a control group from neighboring counties so as not to confound our analysis with regional differences.

As Table 3 shows, there were 56 adult STAR SSI managed care clients receiving DAHS or PAS services in Harris Contiguous Counties. As the table shows, adult STAR SSI managed care clients receiving DAHS or PAS services in Harris Contiguous Counties have a different case-mix than the STAR+PLUS group that this study is focusing on, i.e., the adult SSI STAR+PLUS clients with DAHS or PAS services. Specifically, 17.86% of the adult STAR SSI managed care clients receiving DAHS or PAS services in Harris Contiguous Counties were healthy and 73.22% had a chronic condition. If this CRG distribution is compared to the distribution for STAR+PLUS clients with DAHS or PAS services (with 3.33% healthy and 94.81% with chronic conditions), it could be concluded that STAR SSI managed care clients with DAHS or PAS services form a healthier group.

The CRG distribution for severe chronic illnesses, such as moderate and dominant chronic diseases in two organ system and catastrophic conditions, were different for managed care STAR SSI adult clients receiving DAHS or PAS services in Harris Contiguous Counties when compared to the CRG distribution for these severe chronic illnesses for STAR+PLUS clients with DAHS or PAS services. These differences in the distribution of CRG health status categories coupled with an overall small group of adult STAR SSI managed care clients receiving DAHS or PAS services in Harris Contiguous Counties greatly reduced the possibility of formulating an effective control group for adult STAR+PLUS clients with DAHS or PAS services. As a result, adult STAR SSI

managed care clients receiving DAHS or PAS services statewide were considered in the formulation of the control group.

Table 3: CRG Health Status Categories for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and Adult STAR SSI Managed Care Clients with DAHS or PAS Services in Harris Contiguous Counties

CRG Health Status Categories	Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services		Medicaid-Only Adult STAR SSI Managed Care Clients with DAHS or PAS Services in Harris Contiguous Counties	
	No of Clients	Percent	No of Clients	Percent
1 Healthy	77	3.33	10	17.86
2 Significant Acute	43	1.86	5	8.93
3 Single Minor Chronic	60	2.59	2	3.57
4 Multiple Minor Chronic	16	0.69	0	0.00
5 Single Dominant or Moderate Chronic	713	30.80	13	23.21
6 Pairs-Dominant & Moderate Chronic in 2 Organ Sys	850	36.72	15	26.79
7 Triplets-Dom. & Mod. Chronic in 3 or more Organ Sys	220	9.50	9	16.07
8 Malignancies-Metastatic, Complicated or Dominant	60	2.59	1	1.79
9 Catastrophic	276	11.92	1	1.79
TOTAL	2315	100.00	56	100.00

As Figure 1 shows, statewide adult SSI clients receiving DAHS or PAS services in the STAR managed care program again have a different case-mix than the adult clients with DAHS or PAS services in the STAR+PLUS program. Approximately 20% of the adult SSI beneficiaries receiving DAHS or PAS services enrolled in the STAR managed care program statewide were healthy and only 77.31% had a chronic condition. According to the CRG analysis, the remaining SSI beneficiaries receiving DAHS or PAS services enrolled in the STAR managed care program statewide (2.47%) had a significant acute condition that put them at increased risk for developing chronic conditions.

Given this healthier group of STAR SSI managed care clients with DAHS or PAS services statewide, we relied on stratified random sampling in matching the control and the experiment groups. For stratification, we relied on CRG health status and severity of illness. Random samples from both the adult SSI clients with DAHS or PAS services in the STAR+PLUS program and adult SSI clients with DAHS or PAS services in the STAR managed care program were selected in order to get an exact match on health status and severity of illness. Further stratification by gender and race was also considered in matching the experiment and the control group. But, this level of detailed stratification did not produce satisfactory results. This was due to the fact that some of the cells (especially those for chronic CRG categories such as minor chronic conditions in multiple organ systems, single dominant or moderate chronic conditions and malignancies) were not populated at the gender (mostly male) and race (mostly African American) level for the STAR SSI group receiving DAHS or PAS services.

Figure 1: CRG Health Status Categories for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and Adult STAR SSI Managed Care Clients with DAHS or PAS Services Statewide

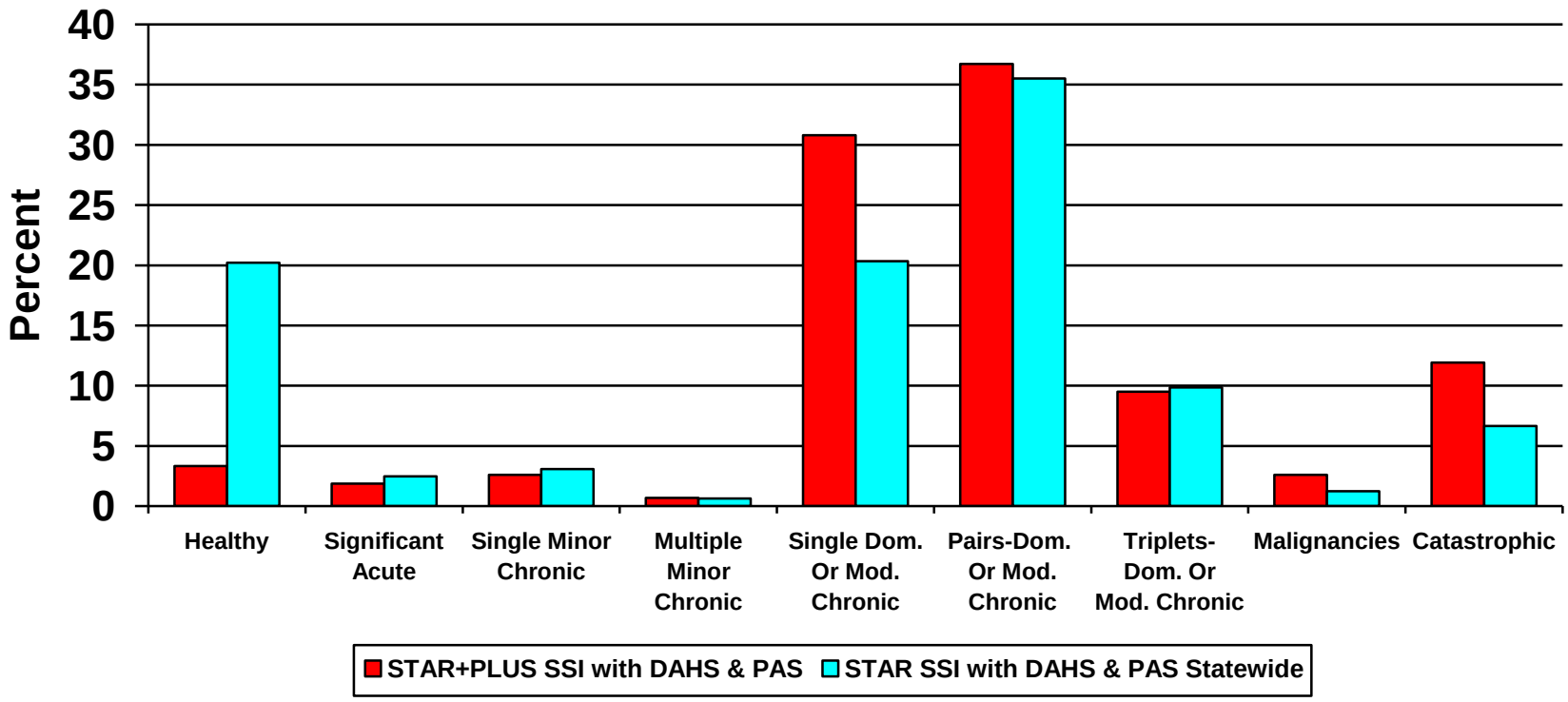

Table 4 provides information on selected characteristics of the STAR+PLUS and STAR adult SSI managed care clients receiving DAHS or PAS services that were randomly selected as an experiment and a control group respectively for the part of this study that examines the impact of care coordination.

When the characteristics of adult STAR SSI managed care clients with DAHS or PAS services in the control group are compared to Medicaid-only adult SSI STAR+PLUS clients receiving DAHS or PAS services, several differences are observed. First, Medicaid-only adult SSI STAR managed care clients receiving DAHS or PAS services are, on average, older than STAR+PLUS adult SSI clients receiving DAHS or PAS services. The proportion of female clients in the STAR+PLUS group receiving DAHS or PAS services is smaller than the proportion of female clients in the control group. The Caucasian and Hispanic clients make up a larger proportion of the control group when compared to that of STAR+PLUS group receiving DAHS or PAS services. These demographic differences between experiment and control group are a direct consequence of the non-populated cells in the STAR SSI group receiving DAHS or PAS services. As described above, these non-populated cells of the STAR SSI group receiving DAHS or PAS services made it impossible to match the control group to the experiment group at the demographic characteristics level. We control for these demographic characteristics in the multivariate part of the analysis presented below.

Table 4: Selected Characteristics of Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and Adult STAR SSI Managed Care Clients with DAHS or PAS Services after Matching on Case-Mix

Category	Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services in the Case-Mix Matched Experiment Group	Medicaid-Only Adult STAR SSI Managed Care Clients with DAHS or PAS Services in the Case-Mix Matched Control Group
N	724	724
Mean (SD) Age	48.94 (13.18)	49.61 (10.89)
Gender		
% Female	61.74	76.80
% Male	38.26	23.20
Race/Ethnicity		
% White	22.10	36.46
% Black	57.46	36.05
% Hispanic	8.84	21.96
% Other	11.60	5.53

STAR+PLUS MCO COMPARISONS

This section of the report focuses on the following question:

> Question 1: Are there differences in health care outcomes across STAR+PLUS MCOs?

The comparison of STAR+PLUS MCOs were conducted both at the descriptive and multivariate level. Health care outcome measures that were taken into consideration in this section are emergency department visits, hospital inpatient stays and total health care costs.

Summary of Findings

- A comparison of the use rates for inpatient stays and emergency department visits across STAR+PLUS MCOs indicated differences at the descriptive level. Specifically, for the sample considered in this focus study, Plan 2 enrollees with DAHS or PAS services have higher rates of inpatient stays and higher rates of emergency department visits when compared to the use rates for those enrollees with DAHS or PAS services in Plan 1. The unadjusted use rates given at the descriptive level do not account for variation in the inpatient and emergency department use rates across health plans due to case-mix and demographic characteristics[4]. Further examination revealed that clients with malignancies and catastrophic conditions make up a larger proportion of the overall pool of enrollees in Plan 2 when compared to Plan 1. These differences in the case-mix may account for differences in the use rates seen at the descriptive level. Multivariate analysis was employed to explore this further. It was found that

[4] Unadjusted use rates (or expenditures) presented throughout this report are average use rates (expenditures) derived from the descriptive analysis. Differences in the use rates (or expenditures) seen at the descriptive level may be due to the variable of interest (e.g. health plans) and/or other factors (such as demographic characteristics). Multivariate regression techniques are used in this report to analyze which of these factors have statistically significant impact on use rates (or expenditures).

these results (that is, Plan 2 enrollees with DAHS or PAS services having higher rates of inpatient stays and higher rates of emergency department visits when compared to the use rates for those enrollees with DAHS or PAS services in Plan 1) persisted after controlling for age, gender and case-mix. These results were statistically significant both for inpatient stays and for emergency department visits.

- A comparison of total health care expenditures across STAR+PLUS MCOs showed that, on average, SSI clients with DAHS or PAS services enrolled in Plan 2 have higher expenditures when compared to expenditures for Plan 1 enrollees. This result persisted after controlling for age, gender and case-mix and was statistically significant.

Inpatient Stays and Emergency Department Visits

Table 5 presents results from descriptive analysis for inpatient stays and emergency department use by STAR+PLUS MCO's[5]. During the study period, 1036 Medicaid-only adult SSI clients with DAHS or PAS services were enrolled in Plan 1, and 1279 Medicaid-only adult SSI STAR+PLUS clients receiving DAHS or PAS services were enrolled in Plan 2[6]. In general, the case-mix distribution at the plan level shows similarities. Over 75% of Medicaid-only adult SSI clients receiving DAHS or PAS services enrolled in both of the STAR+PLUS MCOs have dominant or moderate chronic conditions. Plan 2 has a slightly higher proportion of STAR+PLUS clients with

[5] Due to small number of clients in some of the health status groups, 9 CRG groups were collapsed into 5 for the descriptive and multivariate analysis in this study. As seen in Table 5, first two groups, that is 'Healthy' and 'Significant Acute' CRG categories, were kept the same in the 5 group classification as they are in the 9 CRG classification. The rest of the 7 CRG groups, however, were collapsed into 3 groups. Two minor chronic groups, that is, 'Single Minor Chronic' and 'Multiple Minor Chronic' were combined into one group. Dominant and moderate chronic groups (that is, single dominant or moderate chronic conditions, dominant or moderate chronic conditions in two organ systems (pairs), and dominant or moderate chronic conditions in three or more organ systems (triplets)) were put together into a single group. Lastly, malignancies and catastrophic were combined to form the fifth group in this new classification.

[6] Medicaid-only adult STAR+PLUS SSI clients receiving DAHS or PAS services are very different from the Medicaid-only adult STAR+PLUS SSI clients without DAHS or PAS services. Some of these differences are reflected in use and expenditure tables presented in Appendix B.

malignancies and catastrophic conditions (15.09%) when compared to the proportion of those with malignancies and catastrophic conditions in Plan 1 (13.80%). A slightly higher proportion of STAR+PLUS enrollees in Plan 1 are classified as healthy (3.76%) by the CRG software when compared to the healthy group enrolled in Plan 2 (2.97%).

One of the findings at the descriptive level is the difference between the two STAR+PLUS MCOs in terms of per member per month inpatient and emergency department use rates. Based on the unadjusted use rates presented in Table 5, Plan 2 has, on average, higher inpatient and emergency department visit rates. For example, Plan 2's overall inpatient use rate is 1.37 times higher than Plan 1's overall rate. Plan 2 has higher inpatient use rates in 3 (that is for significant acute, dominant or moderate chronic, and malignancies and catastrophic conditions) out of the 5 CRG groups.

The differences in the use rates between two STAP+PLUS MCOs are more pronounced when emergency department visits are considered. Plan 2 has higher overall emergency department use rate (0.1647) when compared to that of Plan 1 (0.0991). The unadjusted per member per month emergency department visits during the study period are higher for Plan 2 for all of the CRG categories when compared to CRG specific emergency department use rates for Plan 1.

Table 5: Inpatient and ER Use Rates by Plan for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services

STAR+PLUS								
	PLAN 1				PLAN 2			
CRG Health Status Categories	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use
1 Healthy	39	3.76	0.0000	0.0214	38	2.97	0.0000	0.0500
2 Significant Acute	19	1.83	0.0000	0.0614	24	1.88	0.0069	0.1319
3 Single & Multiple Minor Chronic	32	3.09	0.0052	0.0260	44	3.44	0.0038	0.2508
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	803	77.51	0.0506	0.0973	980	76.62	0.0619	0.1495
5 Malignancies & Catastrophic	143	13.80	0.1071	0.1514	193	15.09	0.1740	0.2491
TOTAL	1036	100.00	0.0541	0.0991	1279	100.00	0.0739	0.1647

The unadjusted use rates presented in Table 5 do not account for variation in the inpatient and emergency department use rates across health plans due to case-mix and demographic characteristics. As discussed above, clients with malignancies and catastrophic conditions make up a larger proportion of the overall pool of enrollees in Plan 2 when compared to Plan 1. These differences in the case-mix may account for differences in the use rates seen at the descriptive level.

Multivariate analysis was employed to explore this further. Logistic regressions were used to examine whether the differences in use rates witnessed at the descriptive level still continue to persist when adjustments for case-mix and demographic characteristics are made.

Table 6 shows results from logistic model for inpatient stays[7]. As seen in this table, the likelihood of a hospital stay is significantly different across health plans even after adjusting for age, gender and health status for the sample considered in this study[8]. Specifically, the probability of a hospital stay is higher for those enrolled in Plan 2 than it is for those enrolled in Plan 1. The likelihood of a hospital stay is also higher for females when compared to males; higher for those in the age band 36 to 50 or for those 51 years of age or older when compared to those in the 21-35 age band; and higher for those with malignancies and catastrophic conditions when compared to those in CRG categories representing less severe conditions.

[7] This study used CRG classifications in controlling for case-mix. We are willing to examine the health care outcomes employing other indicators for case-mix such as the functional status. However, data bases housed at ICHP does not include an indicator on functional status. As a result, we would need information on this indicator.

[8] Tables 6, 7 and 9 showing results from multivariate analysis for this section are reproduced in Appendix C to provide specifics on the statistical significance of predictors.

Table 6: Predictors of Inpatient Hospital Stay and Comparison of STAR+PLUS MCOs

Inpatient Hospital Stay and STAR+PLUS MCOs		
Predictors of Inpatient Hospital Stay	**Point Estimate**	**Statistically Significant?**
Intercept	-1.1895	YES
Ages 36-50	0.6822	YES
Ages 51 and above	0.5862	YES
Female	0.3599	YES
White	0.0592	NO
Hispanic	0.0389	NO
Other Race/Ethnicity	-0.3602	NO
CRG—Healthy & Significant Acute	-4.2969	YES
CRG—Single & Multiple Minor Chronic	-1.0787	YES
CRG—Dominant and Moderate Chronic	-0.2393	YES
STAR+PLUS Plan 2	0.1584	YES

Findings are similar for emergency department visits. As seen in Table 7, the likelihood of an emergency department visit is significantly higher for those enrolled in Plan 2 than it is for those enrolled in Plan 1 after adjusting for age, gender and health status. Similar to the findings for the inpatient stays, the likelihood of an emergency department visit is higher for older enrollees when compared to younger enrollees, for females when

compared to males and for those with malignancies and catastrophic conditions when compared to those classified in less severe CRG categories.

Table 7: Predictors of the Emergency Department Visit and the Comparison of STAR+PLUS MCOs

Emergency Department Visits and STAR+PLUS MCOs		
Predictors of Emergency Department Visits	**Point Estimate**	**Statistically Significant?**
Intercept	-0.5731	YES
Ages 36-50	0.4737	YES
Ages 51 and above	0.2512	YES
Female	0.5326	YES
White	-0.0399	NO
Hispanic	-0.0576	NO
Other Race/Ethnicity	-0.6337	YES
CRG—Healthy & Significant Acute	-1.4425	YES
CRG—Single & Multiple Minor Chronic	-0.5465	YES
CRG—Dominant and Moderate Chronic	-0.1637	YES
STAR+PLUS Plan 2	0.2244	YES

Total Health Care Expenditures

Table 8 presents results from descriptive analysis on STAR+PLUS HMO's total health care expenditures for their Medicaid-only adult SSI clients receiving DAHS or PAS services. As discussed above, the case-mix distribution at the plan level shows similarities. In both of the STAR+PLUS plans, over 75% of Medicaid-only adult SSI clients receiving DAHS or PAS services have dominant or moderate chronic conditions. Plan 2 has a slightly higher proportion of SSI clients receiving DAHS or PAS services with malignancies and catastrophic conditions and a lower proportion of healthy SSI enrollees receiving DAHS or PAS services when compared to the respective proportions for Plan 1.

One of the findings at the descriptive level is the difference between the two STAR+PLUS HMOs in terms of per member per month (PMPM) expenditures for their Medicaid-only adult SSI clients receiving DAHS or PAS services. Based on the unadjusted PMPM expenditures presented in Table 8, Plan 2 has, on average, higher expenditures when compared to PMPM expenditures for Plan 1. This holds true both at the overall and the CRG health status level. That is, while Plan1's overall PMPM expenditures for Medicaid-only adult SSI clients receiving DAHS or PAS services are $3050.71, this overall statistics increases to $3708.45 for Plan 2. A comparison of the PMPM expenditures for different CRG health status groups across STAR+PLUS health plans reveal that, for all CRG health status categories, Plan 2's PMPM expenditures for Medicaid-only adult SSI clients receiving DAHS or PAS services are higher than Plan 1's PMPM expenditures.

Multivariate analysis was employed to see if these differences still persist after adjustments for case-mix and demographic characteristics are made. Given the fact that health care expenditures are highly skewed, we relied on regression on the log-scale in this investigation.

Table 8: Total Health Care Expenditures by Plan for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services

STAR+PLUS						
	PLAN 1			PLAN 2		
CRG Health Status Categories	No of Clients	Percent	Overall PMPM Expenditures	No of Clients	Percent	Overall PMPM Expenditures
1 Healthy	39	3.76	597.71	38	2.97	716.70
2 Significant Acute	19	1.83	879.71	24	1.88	1263.45
3 Single & Multiple Minor Chronic	32	3.09	1094.86	44	3.44	1280.23
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	803	77.51	2884.75	980	76.62	3124.11
5 Malignancies & Catastrophic	143	13.80	5377.76	193	15.09	8122.26
TOTAL	1036	100.00	3050.71	1279	100.00	3708.45

As results from this model (Table 9) show, total health care expenditures were significantly higher for those enrolled in Plan 2 when compared to expenditures for those enrolled in Plan 1. This result persists even after controlling for age, gender and health status. Further, these results indicate that total health care expenditures are higher for those in the 36-50 age band or for those 51 years of age or older when compared to those in the 21-35 age band; higher for females when compared to males; lower for all enrollees classified in CRG categories 1 to 4 (i.e., CRG healthy, significant acute, single and multiple minor chronic, and dominant and moderate chronic) when compared to those with malignancies and catastrophic conditions.

Table 9: Predictors of Total Health Care Expenditures and the Comparison of STAR+PLUS MCOs

Total Health Care Expenditures and STAR+PLUS MCOs		
Predictors of Health Care Expenditures	**Point Estimate**	**Statistically Significant?**
Intercept	7.7107	YES
Ages 36-50	0.2027	YES
Ages 51 and above	0.3035	YES
Female	0.2757	YES
White	-0.0311	NO
Hispanic	0.1245	YES
Other Race/Ethnicity	-0.1793	YES
CRG—Healthy	-2.4958	YES
CRG—Significant Acute	-1.5623	YES
CRG—Single & Multiple Minor Chronic	-1.4061	YES
CRG—Dominant and Moderate Chronic	-0.7774	YES
STAR+PLUS PLAN 2	0.2054	YES

THE IMPACT OF CARE COORDINATION

As discussed in the earlier sections of this report, the Texas STAR+PLUS pilot program has adopted a highly integrated approach in dealing with coordination issues that often arise in the provision of health care to patients with complex needs. MCOs participating in this pilot program are responsible for coordinating acute and long term care needs of Medicaid populations through the use of a Care Coordinator. In this highly integrated health care delivery system, the Care Coordinators' responsibilities become most crucial when the integration of acute and long term care services involves clients who are receiving community-based long term care services. This focus study's main objective is to unravel the impact of care coordination on health care outcomes for these clients.

To examine the impact of care coordination, this study employs a quasi-experimental design. In this analysis, a subset of Medicaid-only adult SSI STAR+PLUS enrollees with DAHS or PAS services are compared to a similar group of SSI enrollees with DAHS or PAS services enrolled in the Texas STAR managed care program. These two groups were matched based on case-mix employing CRG health status and severity of illness assignments.

This section of the report focuses on the following questions:

> Question 2: How does Care Coordination provided in the STAR+PLUS program affect health care outcomes?
> Question 3: Does the Care Coordination provided in the STAR+PLUS program affect health care outcomes differently for enrollees in different health status groups?

The comparison of STAR+PLUS and STAR enrollees were conducted both at the descriptive and multivariate level. Health care outcome measures that were taken into consideration in this section are emergency department visits, hospital inpatient stays and total health care costs.

Summary of Findings

- A comparison of the use rates for inpatient stays and emergency department visits for the STAR+PLUS experiment and STAR control groups indicated differences at the descriptive level. Specifically, SSI clients with DAHS or PAS services enrolled in the STAR managed care program (the control group) have higher rates of inpatient stays and higher rates of emergency department visits when compared to the use rates for those enrolled in the STAR+PLUS group (the experiment group). These results persisted after controlling for age, gender and case-mix and were statistically significant.

- A comparison of the total health care expenditures at the descriptive level revealed that those enrolled in STAR (the control group) have higher PMPM expenditures than those enrolled in STAR+PLUS (the experiment group). Further, it was found that the discrepancy in PMPM expenditures are quite pronounced for chronic CRG categories. Results from multivariate analysis also show that PMPM expenditures are lower for the STAR+PLUS group after controlling for age, gender and case-mix. This result was statistically significant.

Inpatient Stays and Emergency Department Visits

Table 10 presents results from descriptive analysis for inpatient stays and emergency department use for experiment and control groups. Since the STAR+PLUS and STAR adult SSI populations receiving DAHS or PAS services have different case-mix distributions, stratified random sampling was used in matching the experiment and the control group on a case-mix basis for this part of the study. CRG health status categories and the severity of illness assignments were employed in this matching process. This case-mix matching provides an opportunity to compare the two groups in terms of inpatient stays and emergency department visits while keeping the health status and the severity of illness constant.

As Table 10 shows, in the case-mix matched sample, there were 724 Medicaid-only adult SSI STAR+PLUS clients receiving DAHS or PAS services (the experiment group) who were enrolled in the program for at least 3 consecutive months during State Fiscal Year 2002. The number of STAR+PLUS clients shown in Table 10 for CRG categories from significant acute through malignancies and catastrophic conditions are a result of stratified random sampling to make the experiment group comparable to the STAR control group. As described above, this random sampling was based on CRG health status and severity of illness assignments. On the other hand, all the STAR+PLUS clients in CRG healthy group were included in the formulation of the experiment group for analysis in this part of the study. This is due to the fact that CRG healthy group (n=77) among STAR+PLUS clients with DAHS or PAS services (the experiment group) was smaller than the CRG healthy group (n=164) among STAR SSI managed care clients (the control group) with DAHS or PAS services.

As described previously, this study relies on information from the Texas STAR managed care program, the Medicaid managed care program in Texas, in formulating a comparison group for STAR+PLUS enrollees with DAHS or PAS services. Since the STAR adult SSI population receiving DAHS or PAS services had a greater number of clients classified as healthy by the CRGs, a random sample of 77 (out of 164) clients were selected in the healthy category to make it comparable to the healthy group in the experiment group. On the other hand, all of the STAR adult SSI managed care clients receiving DAHS or PAS services for CRG categories from significant acute through malignancies and catastrophic conditions were included in the control group. In fact, the number of STAR adult SSI managed care clients receiving DAHS or PAS services for CRG categories from significant acute through malignancies and catastrophic conditions formed the basis for stratified random sampling in the experiment group. As a result, by construct, the CRG distribution for STAR adult SSI managed care clients with DAHS or PAS services shown in Table 10 are exactly the same as the CRG distribution for STAR+PLUS enrollees with DAHS or PAS services.

One of the findings at the descriptive level is the difference between per member per month inpatient and emergency department use rates for the experiment and control groups. Based on the unadjusted use rates presented in Table 10, adult SSI clients with DAHS or PAS services enrolled in the Texas STAR managed care program, on average, have higher inpatient and emergency department visit rates. In terms of per member per month inpatient stays, adult STAR SSI managed care clients' overall use rate (0.0953) is higher than STAR+PLUS enrollees' overall rate (0.0741)[9]. This result also holds true for most of the CRG health status groups. Adult STAR SSI managed care clients have higher inpatient use rates than STAR+PLUS enrollees for each of the CRG groups with the exception of the healthy group where both of the groups are non-users.

The use rates between the two groups show discrepancies when emergency department visits are considered. The control group, on average, has higher overall emergency department use rate (0.2338) when compared to the emergency department use rate for the STAR+PLUS group (0.1439). That is, on average, adult STAR SSI managed care clients with DAHS or PAS services in the control group used the emergency department 1.62 times more than the STAR+PLUS clients with DAHS or PAS services. The unadjusted per member per month use rate for emergency department visits are higher for adult STAR SSI group for all of the CRG categories when compared to CRG specific emergency department use rates for STAR+PLUS group with the exception of the healthy and the significant acute CRG group.

The unadjusted use rates presented in Table 10 do not account for variation in the inpatient and emergency department use rates across programs due to demographic characteristics. Multivariate analysis was employed to explore whether results seen at the descriptive level would persist when adjustments for demographic conditions are made. Logistic regressions were used in this analysis.

[9] All the use rates presented in this report are average rates based on per member per month use. An use rate on a per member per month basis for a service such as an inpatient stay that is less than one indicates that an average client does not use that service as many times as the number of months she/he is enrolled.

Table 10: Inpatient and ER Use Rates Comparisons for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and STAR Control Group

EXPERIMENT AND CONTROL GROUP COMPARISONS								
	STAR+PLUS (Medicaid-Only Adult SSI Clients with DAHS or PAS Services)				STAR CONTROL (Medicaid-Only Adult SSI Managed Care Clients with DAHS or PAS Services)			
CRG Health Status Categories	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use
1 Healthy	77	10.64	0.0000	0.0355	77	10.64	0.0000	0.0206
2 Significant Acute	20	2.76	0.0000	0.1583	20	2.76	0.0250	0.1458
3 Single & Multiple Minor Chronic	30	4.14	0.0000	0.0389	30	4.14	0.0056	0.0972
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	533	73.62	0.0748	0.1492	533	73.62	0.0993	0.2435
5 Malignancies & Catastrophic	64	8.84	0.2154	0.2755	64	8.84	0.2406	0.5013
TOTAL	724	100.00	0.0741	0.1439	724	100.00	0.0953	0.2338

As Table 11 shows, results from the logistic model for inpatient stays are similar to the findings at the descriptive level[10]. That is, the likelihood of an inpatient stay is lower for those SSI clients in the STAR+PLUS program than it is for SSI clients in the STAR managed care program. This result continues to be significant after controlling for demographic characteristics.

Further, the results in Table 11 indicate that the likelihood of an inpatient stay is higher for clients in the 36-50 age band or for those 51 years of age or older when compared to those in the 21-35 age band. The likelihood of an inpatient stay is lower for all enrollees classified in CRG categories 1 to 4 (i.e., CRG healthy, significant acute, single and multiple minor chronic, and dominant and moderate chronic) when compared to those with malignancies and catastrophic conditions.

[10] Tables 11, 12 and 14 showing results from multivariate analysis for this section are reproduced in Appendix D to provide specifics on the statistical significance of predictors.

Table 11: Predictors of Inpatient Hospital Stay and Comparison of Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and STAR Control Group

Inpatient Hospital Stay and STAR+PLUS vs. STAR Control		
Predictors of Inpatient Hospital Stay	**Point Estimate**	**Statistically Significant?**
Intercept	-0.4740	NO
Ages 36-50	0.4521	YES
Ages 51 and above	0.4676	YES
Female	0.2712	NO
White	0.2061	NO
Hispanic	-0.0982	NO
Other Race/Ethnicity	0.1625	NO
CRG—Healthy & Significant Acute	-4.2879	YES
CRG—Single & Multiple Minor Chronic	-1.4332	YES
CRG—Dominant and Moderate Chronic	-0.2765	YES
STAR+PLUS Experiment Group	-0.1437	YES

As Table 12 shows, logistic model gives a similar result for emergency department visits. The likelihood of having an emergency department visit is significantly lower for STAR+PLUS clients with DAHS or PAS services than the likelihood of emergency department visits for SSI STAR managed care clients with DAHS or PAS services. Further, these results indicate that the likelihood of having an emergency department visit is higher for clients in the 36-50 age band when compared to those in the 21-35 age band; higher for females when compared to males; higher for Caucasians when compared to African Americans; lower for all enrollees classified in CRG categories 1 to 4 (i.e., CRG healthy, significant acute, single and multiple minor chronic, and dominant and moderate chronic) when compared to those with malignancies and catastrophic conditions.

Table 12: Predictors of Emergency Department Visit and Comparison of Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS services and STAR Control Group

Emergency Department Visits and STAR+PLUS vs. STAR Control		
Predictors of Emergency Department Visit	**Point Estimate**	**Statistically Significant?**
Intercept	0.0344	NO
Ages 36-50	0.4692	YES
Ages 51 and above	0.1896	NO
Female	0.3513	YES
White	0.3052	YES
Hispanic	0.0456	NO
Other Race/Ethnicity	-0.3208	NO
CRG—Healthy & Significant Acute	-2.1838	YES
CRG—Single & Multiple Minor Chronic	-0.5680	YES
CRG—Dominant and Moderate Chronic	-0.2028	YES
STAR+PLUS Experiment Group	-0.1895	YES

Total Health Care Expenditures

Table 13 presents results from descriptive analysis for total health care expenditures for the control and the experiment group. As discussed in the previous section, during the study period, there were 724 Medicaid-only adult SSI clients receiving DAHS or PAS services in the STAR+PLUS program that were matched on a case-mix basis to adult STAR SSI managed care clients receiving DAHS or PAS services in the control group. As a result of this construct, the PMPM expenditures for the two groups could be compared while keeping the case-mix constant.

As Table 13 shows, one of the findings at the descriptive level is the difference between the PMPM expenditures for the experiment and the control group. Based on the unadjusted PMPM expenditures presented in Table 13, control group consisting of adult STAR SSI managed care clients with DAHS or PAS services, on average, have higher expenditures when compared to PMPM expenditures for the experiment group. This holds true both at the overall and the CRG health status level with the exception of the CRG healthy group. That is, while the experiment group's overall PMPM expenditures are $3,648.18, this overall statistics increases to $13,823.55 for the control group.

A comparison of PMPM expenditures for different CRG health status groups for managed care STAR SSI and STAR+PLUS SSI clients receiving DAHS or PAS services reveal differences. For the CRG healthy group, PMPM expenditures are lower for adult STAR SSI managed care clients with DAHS or PAS services than they are for adult STAR+PLUS SSI clients. But PMPM expenditures are higher for adult STAR SSI managed care clients than they are for adult STAR+PLUS SSI clients for all of the other CRG categories. One of the findings of this study is that the discrepancy in PMPM expenditures can be quite high for some of the CRG categories. For example, the PMPM expenditures for those with malignancies or catastrophic conditions are 3.47 times higher for the STAR group than it is for the STAR+PLUS group. And the discrepancy in PMPM expenditures increases to 3.98 times for those with moderate or dominant chronic conditions.

Table 13: Total Health Care Expenditure Comparisons for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and STAR Control Group

EXPERIMENT AND CONTROL GROUP COMPARISONS						
	STAR+PLUS (Medicaid-Only Adult SSI Clients with DAHS or PAS Services)			STAR CONTROL (Medicaid-Only Adult SSI Managed Care Clients with DAHS or PAS Services)		
CRG Health Status Categories	No of Clients	Percent	Overall PMPM Expenditures	No of Clients	Percent	Overall PMPM Expenditures
1 Healthy	77	10.64	656.43	77	10.64	297.99
2 Significant Acute	20	2.76	933.17	20	2.76	3685.12
3 Single & Multiple Minor Chronic	30	4.14	1063.47	30	4.14	4290.28
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	533	73.62	3582.39	533	73.62	14249.52
5 Malignancies & Catastrophic	64	8.84	9855.57	64	8.84	34185.88
TOTAL	724	100.00	3648.18	724	100.00	13823.55

Multivariate analysis was employed to see if these differences in expenditures still persist after adjustments for case-mix and demographic characteristics are made. As results from this model (Table 14) show, total health care expenditures are lower for those enrolled in the STAR+PLUS program when compared to expenditures for those enrolled in the STAR managed care program. Further, these results indicate that total health care expenditures are higher for those in the 36-50 age band or for those 51 years of age or older when compared to those in the 21-35 age band; higher for females when compared to males; higher for Caucasians when compared to African Americans; lower for all enrollees classified in CRG categories 1 to 4 (i.e., CRG healthy, significant acute, single and multiple minor chronic, and dominant and moderate chronic) when compared to those with malignancies and catastrophic conditions.

Table 14: Predictors of Total Health Care Expenditures and the Comparison for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and STAR Control Group

Total Health Care Expenditures and STAR+PLUS vs. STAR Control		
Predictors of Health Care Expenditures	**Point Estimate**	**Statistically Significant?**
Intercept	8.3762	YES
Ages 36-50	0.4582	YES
Ages 51 and above	0.6880	YES
Female	0.2021	YES
White	0.2623	YES
Hispanic	0.1492	NO
Other Race/Ethnicity	-0.0187	NO
CRG—Healthy	-4.9853	YES
CRG—Significant Acute	-2.1631	YES
CRG—Single & Multiple Minor Chronic	-2.3002	YES
CRG—Dominant and Moderate Chronic	-1.0290	YES
STAR+PLUS Experiment Group	-0.2556	YES

DISCUSSION

Managed care organizations participating in the STAR+PLUS program are responsible for coordinating acute and long term care needs of Medicaid populations through the use of a Care Coordinator. The responsibilities of the Care Coordinator become most crucial when the integration of acute and long term care services involves those receiving community-based long term care services. This is the reason why the analysis in this study was limited to adult STAR+PLUS enrollees with DAHS and PAS services.

Three health care outcome measures (emergency department visits, hospital inpatient stays and total health care costs) were taken into consideration in examining the impact of care coordination. Information from the STAR managed care program, the Medicaid managed care program in Texas, was used in formulating a comparison group for STAR+PLUS enrollees with DAHS or PAS services. Results from these comparisons show that care coordination efforts in the STAR+PLUS program are having a positive impact on reducing inpatient stays and emergency department use. Results from the comparison of total health care expenditures, although inconclusive, point to a cost lowering tendency of care coordination efforts in the STAR+PLUS program.

One area of further research would be to see if this study's results persist when longer time horizons are considered. Another area of further research would be to examine the impact of care coordination on STAR+PLUS enrollees with specific conditions. For example, integrated health care delivery system's impact on health care outcomes for those with a mental health diagnosis is one of the topics that have been the focus of recent discussions in the literature.

APPENDIX A: LOCAL CODES FOR DAY ACTIVITY AND HEALTH SERVICES (DAHS) AND PERSONAL ASSISTANCE SERVICES (PAS)

DAHS Local Code	Description
700SP	Day Activity and Health Services (3 ─ 6 hours)
701SP	Day Activity and Health Services (over 6 hours)

PAS Local Code	Description
600SP	Professional Personal Attendant Care ─ Non-Priority (1 hour)
601SP	Professional Personal Attendant Care ─ Priority (1 hour)
602SP	Non-Professional Personal Attendant Care ─ Non-Priority (1 hour)
603SP	Non-Professional Personal Attendant Care ─ Priority (1 hour)
604SP	Professional Personal Attendant Care ─ NOS (1 hour)
605SP	Non-Professional Personal Attendant Care ─ NOS (1 hour)

APPENDIX B: MEDICAID-ONLY ADULT STAR+PLUS SSI CLIENTS WITH AND WITHOUT DAHS OR PAS SERVICES

Table 1B: Inpatient and ER Use Rates for Medicaid-Only Adult STAR+PLUS SSI Clients with and without DAHS or PAS Services

STAR+PLUS								
	Medicaid-Only Adult SSI Clients with DAHS or PAS Services				Medicaid-Only Adult SSI Clients without DAHS or PAS Services			
CRG Health Status Categories	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use
1 Healthy	77	3.33	0.0000	0.0355	5783	37.55	0.0005	0.0283
2 Significant Acute	43	1.86	0.0039	0.1008	740	4.80	0.0107	0.1137
3 Single & Multiple Minor Chronic	76	3.28	0.0044	0.1561	988	6.41	0.0077	0.0669
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	1783	77.02	0.0568	0.1260	6941	45.07	0.0435	0.1097
5 Malignancies & Catastrophic	336	14.51	0.1455	0.2075	950	6.17	0.0963	0.1681
TOTAL	2315	100.00	0.0651	0.1353	15402	100.00	0.0267	0.0802

Table 2B: Inpatient and ER Use Rates by Plan for Medicaid-Only Adult STAR+PLUS SSI Clients without DAHS or PAS Services

STAR+PLUS								
	PLAN 1				PLAN 2			
CRG Health Status Categories	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use	No of Clients	Percent	PMPM Inpatient Use – Stays	PMPM ER Use
1 Healthy	3160	37.10	0.0006	0.0241	2623	38.10	0.0005	0.0333
2 Significant Acute	374	4.39	0.0036	0.1127	366	5.32	0.0180	0.1147
3 Single & Multiple Minor Chronic	455	5.34	0.0089	0.0536	533	7.74	0.0068	0.0783
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	3962	46.52	0.0453	0.0916	2979	43.27	0.0410	0.1338
5 Malignancies & Catastrophic	566	6.65	0.1022	0.0241	384	5.58	0.0877	0.1978
TOTAL	8517	100.00	0.0287	0.0692	6885	100.00	0.0243	0.0938

Table 3B: Total Health Care Expenditures for Medicaid-Only Adult STAR+PLUS SSI Clients with and without DAHS or PAS Services

STAR+PLUS						
	Medicaid-Only Adult SSI Clients with DAHS or PAS Services			Medicaid-Only Adult SSI Clients without DAHS or PAS Services		
CRG Health Status Categories	No of Clients	Percent	Overall PMPM Expenditures	No of Clients	Percent	Overall PMPM Expenditures
1 Healthy	77	3.33	656.43	5783	37.55	128.64
2 Significant Acute	43	1.86	1093.89	740	4.80	473.98
3 Single & Multiple Minor Chronic	76	3.28	1202.18	988	6.41	444.88
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	1783	77.02	3016.31	6941	45.07	1497.97
5 Malignancies & Catastrophic	336	14.51	6954.22	950	6.17	3148.54
TOTAL	2315	100.00	3414.10	15402	100.00	968.88

Table 4B: Total Health Care Expenditures by Plan for Medicaid-Only Adult STAR+PLUS SSI Clients without DAHS or PAS Services

STAR+PLUS						
	PLAN 1			PLAN 2		
CRG Health Status Categories	No of Clients	Percent	Overall PMPM Expenditures	No of Clients	Percent	Overall PMPM Expenditures
1 Healthy	3160	37.10	127.26	2623	38.10	130.30
2 Significant Acute	374	4.39	373.27	366	5.32	576.90
3 Single & Multiple Minor Chronic	455	5.34	442.10	533	7.74	447.25
4 Dominant or Moderate Chronic-Single, Pairs & Triplets	3962	46.52	1569.38	2979	43.27	1403.01
5 Malignancies & Catastrophic	566	6.65	3261.62	384	5.58	2981.87
TOTAL	8517	100.00	1034.03	6885	100.00	888.30

APPENDIX C: RESULTS FROM MULTIVARIATE ANALYSIS WITH SIGNIFICANCE LEVELS FOR THE SECTION TITLED "STAR+PLUS MCO COMPARISONS"

Table 1C (Corresponds to Table 6 in STAR+PLUS MCO COMPARISONS section): Predictors of Inpatient Hospital Stay and Comparison of STAR+PLUS MCOs

Inpatient Hospital Stay and STAR+PLUS MCOs		
Predictors of Inpatient Hospital Stay	**Point Estimate**	**Significance Level**
Intercept	-1.1895	<.0001
Ages 36-50	0.6822	<.0001
Ages 51 and above	0.5862	0.0002
Female	0.3599	0.0019
White	0.0592	0.6600
Hispanic	0.0389	0.8180
Other Race/Ethnicity	-0.3602	0.0579
CRG—Healthy & Significant Acute	-4.2969	<.0001
CRG—Single & Multiple Minor Chronic	-1.0787	<.0001
CRG—Dominant and Moderate Chronic	-0.2393	<.0001
STAR+PLUS Plan 2	0.1584	0.0032

Table 2C (Corresponds to Table 7 in STAR+PLUS MCO COMPARISONS section): Predictors of the Emergency Department Visit and the Comparison of STAR+PLUS MCOs

Emergency Department Visits and STAR+PLUS MCOs		
Predictors of Emergency Department Visits	**Point Estimate**	**Significance Level**
Intercept	-0.5731	0.0002
Ages 36-50	0.4737	0.0003
Ages 51 and above	0.2512	0.0468
Female	0.5326	<.0001
White	-0.0399	0.7290
Hispanic	-0.0576	0.6923
Other Race/Ethnicity	-0.6337	<.0001
CRG—Healthy & Significant Acute	-1.4425	<.0001
CRG—Single & Multiple Minor Chronic	-0.5465	<.0001
CRG—Dominant and Moderate Chronic	-0.1637	<.0001
STAR+PLUS Plan 2	0.2244	<.0001

Table 3C (Corresponds to Table 9 in STAR+PLUS MCO COMPARISONS section): Predictors of Total Health Care Expenditures and the Comparison of STAR+PLUS MCOs

Total Health Care Expenditures and STAR+PLUS MCOs		
Predictors of Health Care Expenditures	**Point Estimate**	**Significance Level**
Intercept	7.7107	<.0001
Ages 36-50	0.2027	0.0014
Ages 51 and above	0.3035	<.0001
Female	0.2757	<.0001
White	-0.0311	0.5881
Hispanic	0.1245	0.0874
Other Race/Ethnicity	-0.1793	0.0143
CRG—Healthy	-2.4958	<.0001
CRG—Significant Acute	-1.5623	<.0001
CRG—Single & Multiple Minor Chronic	-1.4061	<.0001
CRG—Dominant and Moderate Chronic	-0.7774	<.0001
STAR+PLUS PLAN 2	0.2054	<.0001

APPENDIX D: RESULTS FROM MULTIVARIATE ANALYSIS WITH SIGNIFICANCE LEVELS FOR THE SECTION TITLED "THE IMPACT OF CARE COORDINATION"

Table 1D (Corresponds to Table 11 in THE IMPACT OF CARE COORDINATION section): Predictors of Inpatient Hospital Stay and Comparison of Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and STAR Control Group

Inpatient Hospital Stay and STAR+PLUS vs. STAR Control		
Predictors of Inpatient Hospital Stay	**Point Estimate**	**Significance Level**
Intercept	-0.4740	0.0590
Ages 36-50	0.4521	0.0264
Ages 51 and above	0.4676	0.0158
Female	0.2712	0.0646
White	0.2061	0.1755
Hispanic	-0.0982	0.6106
Other Race/Ethnicity	0.1625	0.4869
CRG—Healthy & Significant Acute	-4.2879	<.0001
CRG—Single & Multiple Minor Chronic	-1.4332	<.0001
CRG—Dominant and Moderate Chronic	-0.2765	<.0001
STAR+PLUS Experiment Group	-0.1437	0.0310

Table 2D (Corresponds to Table 12 in THE IMPACT OF CARE COORDINATION section): Predictors of Emergency Department Visit and Comparison of Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and STAR Control Group

Emergency Department Visits and STAR+PLUS vs. STAR Control		
Predictors of Emergency Department Visit	**Point Estimate**	**Significance Level**
Intercept	0.0344	0.8839
Ages 36-50	0.4692	0.0056
Ages 51 and above	0.1896	0.2392
Female	0.3513	0.0058
White	0.3052	0.0229
Hispanic	0.0456	0.7841
Other Race/Ethnicity	-0.3208	0.1381
CRG—Healthy & Significant Acute	-2.1838	<.0001
CRG—Single & Multiple Minor Chronic	-0.5680	<.0001
CRG—Dominant and Moderate Chronic	-0.2028	<.0001
STAR+PLUS Experiment Group	-0.1895	0.0012

Table 3D (Corresponds to Table 14 in THE IMPACT OF CARE COORDINATION section): Predictors of Total Health Care Expenditures and the Comparison for Medicaid-Only Adult STAR+PLUS SSI Clients with DAHS or PAS Services and STAR Control Group

Total Health Care Expenditures and STAR+PLUS vs. STAR Control		
Predictors of Health Care Expenditures	**Point Estimate**	**Significance Level**
Intercept	8.3762	<.0001
Ages 36-50	0.4582	0.0020
Ages 51 and above	0.6880	<.0001
Female	0.2021	0.0685
White	0.2623	0.0285
Hispanic	0.1492	0.3172
Other Race/Ethnicity	-0.0187	0.9189
CRG—Healthy	-4.9853	<.0001
CRG—Significant Acute	-2.1631	<.0001
CRG—Single & Multiple Minor Chronic	-2.3002	<.0001
CRG—Dominant and Moderate Chronic	-1.0290	<.0001
STAR+PLUS Experiment Group	-0.2556	0.0143

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